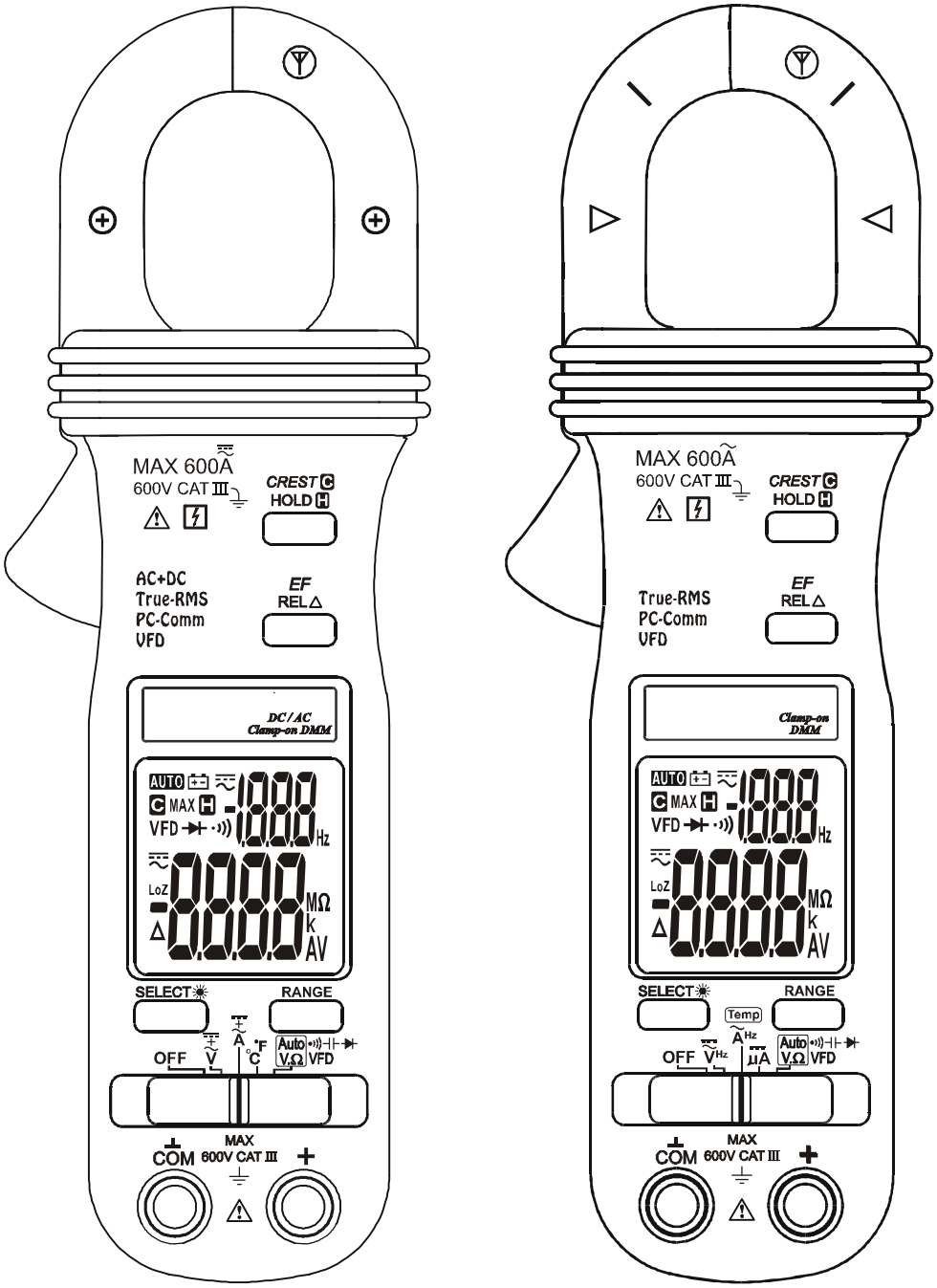


USER'S MANUAL

DCA/ACA Models:

TBM186 & TBM189

ACA Models:

TBM181, TBM183,
TBM185 & TBM188

Versatile Clamp-on Multimeter Series

TOP TRONIC
HellermannTyton

BRYMEN®
BRIGHT PEOPLE'S CHOICE

1) SAFETY

This manual contains information and warnings that must be followed for operating the instrument safely and maintaining the instrument in a safe operating condition. If the instrument is used in a manner not specified by the manufacturer, the protection provided by the instrument may be impaired.

The meter protection rating, against the users, is double insulation per IEC/EN61010-1 2nd Ed., UL61010-1 2nd Ed., CAN/CSA C22.2 No. 61010.1-0.92, IEC/EN61010-2-032, UL61010B-2-032, CAN/CSA C22.2 No. 61010-2-032-04 & IEC/EN61010-031:2002/A1:2008:

Measurement Category III 600V AC & DC.

Per IEC61010-1 (2010) OVERVOLTAGE CATEGORY

OVERVOLTAGE CATEGORY II (CAT II) is for equipment intended to be supplied from the building wiring. It applies both to plug-connected equipment and to PERMANENTLY CONNECTED EQUIPMENT.

OVERVOLTAGE CATEGORY III (CAT III) is for equipment intended to form part of a building wiring installation. Such equipment includes socket outlets, fuse panels, and some MAINS installation control equipment.

OVERVOLTAGE CATEGORY IV (CAT IV) is for equipment installed at or near the origin of the electrical supply to a building, between the building entrance and the main distribution board. Such equipment may include electricity tariff meters and primary overcurrent protection devices.

TERMS IN THIS MANUAL

WARNING identifies conditions and actions that could result in serious injury or even death to the user.

CAUTION identifies conditions and actions that could cause damage or malfunction in the instrument.

WARNING

To reduce the risk of fire or electric shock, do not expose this product to rain or moisture. The meter is intended only for indoor use.

To avoid electrical shock hazard, observe the proper safety precautions when working with voltages above 60 VDC or 30 VAC rms. These voltage levels pose a potential shock hazard to the user. Before and after hazardous voltage measurements, test the voltage function on a known source such as line voltage to determine proper meter functioning.

Keep your hands/fingers behind the hand/finger barriers (of the meter and the test leads) that indicate the limits of safe access of the hand-held part during measurement. Inspect test leads, connectors, and probes for damaged insulation or exposed metal before using the instrument. If any defects are found, replace them immediately. Only use the test lead provided with the equipment or UL Listed Probe Assembly rated CAT III 600V or better.

This Clamp-on meter is designed to apply around or remove from uninsulated hazardous live conductors. But still, individual protective equipment must be used if hazardous live parts in the installation where measurement is to be carried out could be accessible.

CAUTION

Disconnect the test leads from the test points before changing meter functions.

INTERNATIONAL ELECTRICAL SYMBOLS

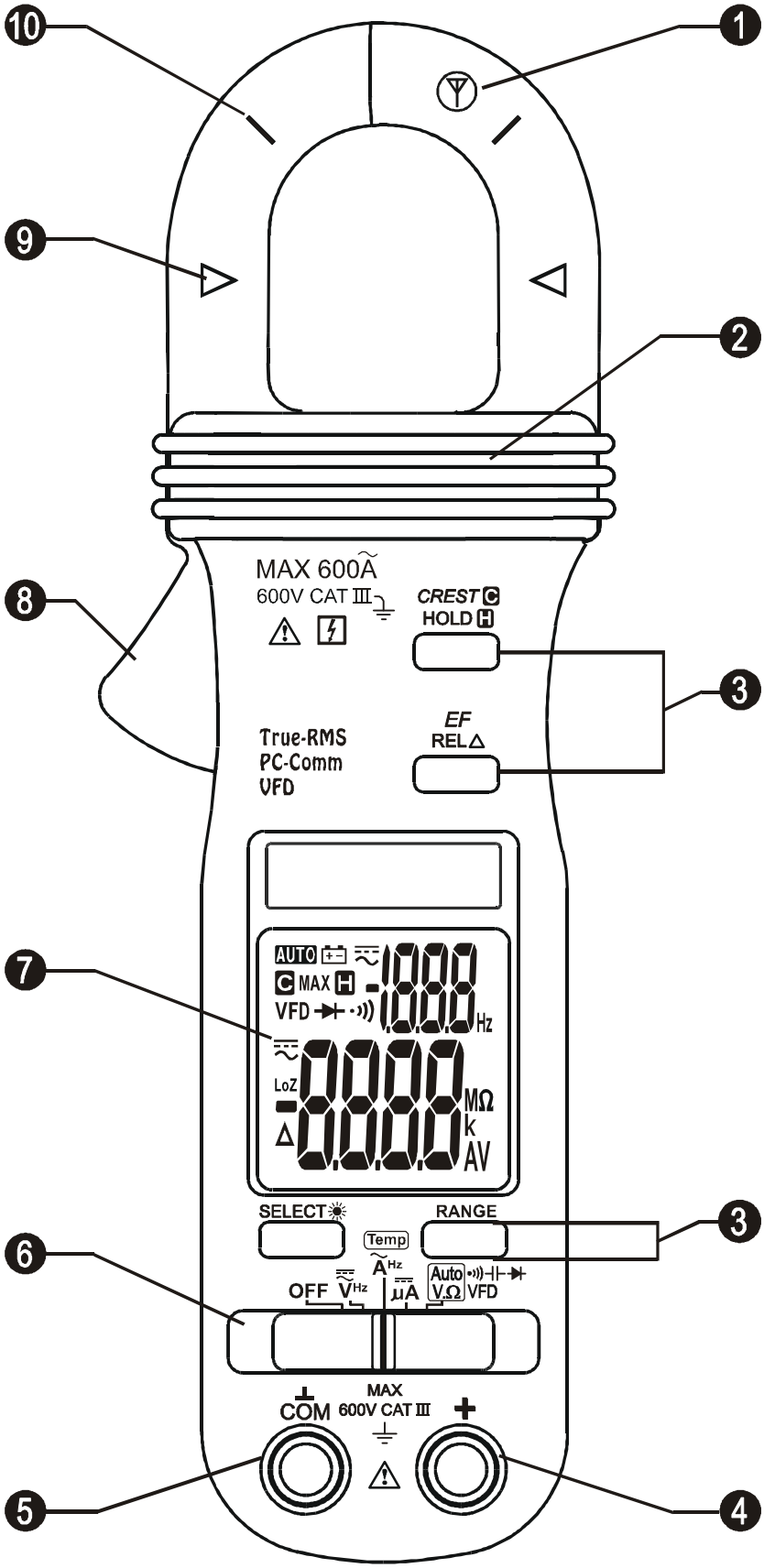
⚠	Caution ! Refer to the explanation in this Manual
⚠	Caution ! Risk of electric shock
⏚	Earth (Ground)
⧈	Double Insulation or Reinforced insulation
⎓	Fuse
~	AC--Alternating Current
⎓	DC--Direct Current
⚡	Application around and removal from hazardous live conductors is permitted

2) CENELEC Directives

The instruments conform to CENELEC Low-voltage directive 2006/95/EC and Electromagnetic compatibility directive 2004/108/EC

3) PRODUCT DESCRIPTION

This user's manual uses only representative model(s) for illustrations. Please refer specification details for function availability to each model.



1) Antenna for Non-Contact EF-Detection

2) Hand/Finger Barrier to indicate the limits of safe access of the meter during measurement

3) Push-buttons for special functions & features.

4) Input Jack for all functions EXCEPT non-invasive DCA or ACA current functions

5) Common (Ground reference) Input Jack for all functions EXCEPT non-invasive DCA or ACA current functions

6) Slide-switch Selector to turn the power ON/OFF and Select a function

7) 3-5/6 digits 6000 counts & 3-1/2 digits 2000 counts dual numeric LCD display

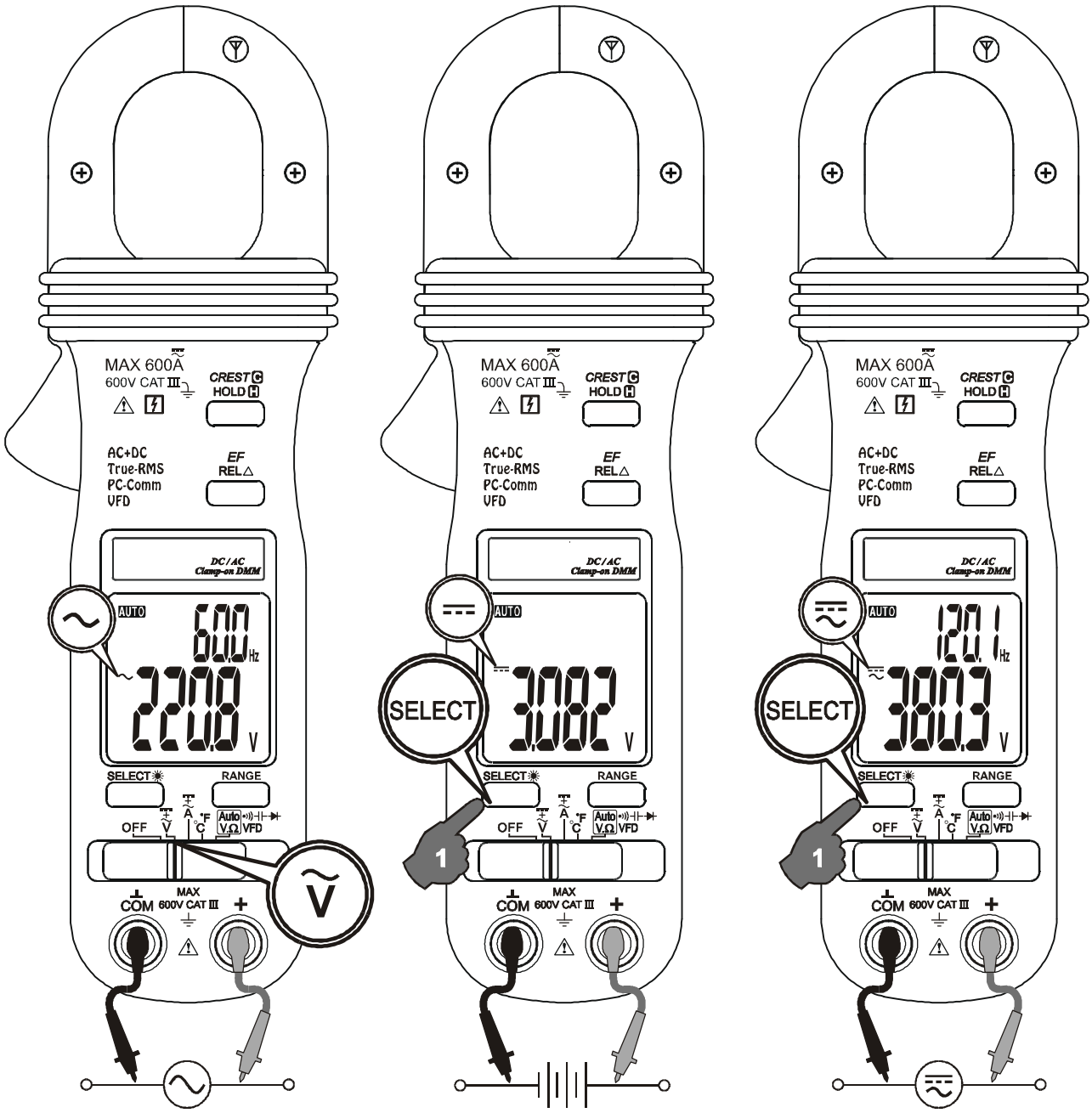
8) Jaw trigger for opening the clamp jaw

9) Jaw center indicator (with DCA polarity for Models 186 & 189), at where best DCA or ACA accuracy is specified

10) Jaw marking line for ACA position error indication (Models 181, 183, 185 & 188 only)

4) OPERATION

CAUTION: Before and after hazardous voltage measurements, test the voltage function on a known source such as line voltage to determine proper meter functioning.



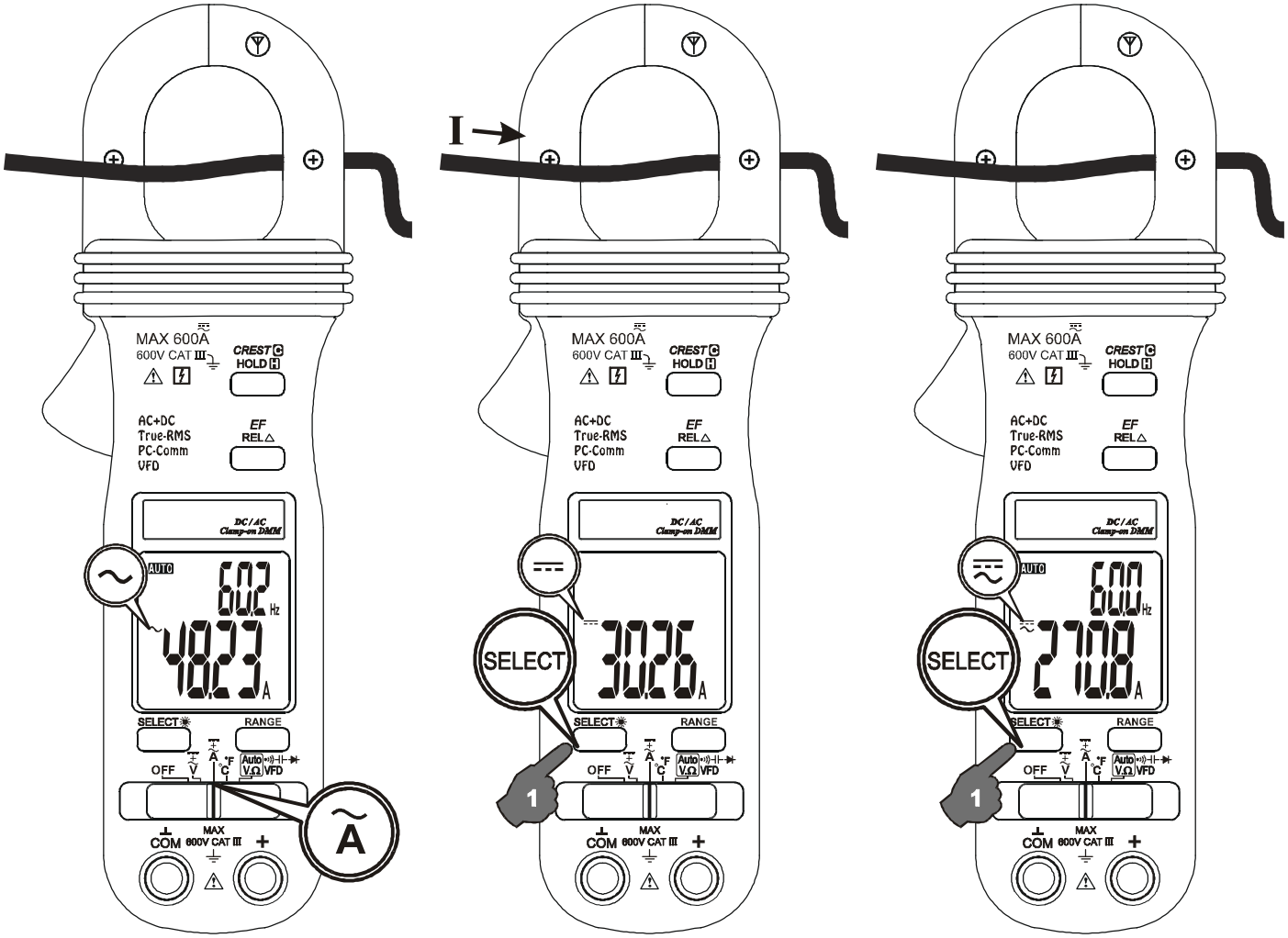
ACV ^{Hz}, DCV & DC+ACV ^{Hz} (Model 189 only) functions

Set slide-switch to Voltage function position(s). Inputs are made through the test leads terminals. Defaults at **ACV** ^{Hz} Function. Press **SELECT** button momentarily and release to select the subject functions in sequence. For Models 181 & 183, **ACV** ^{Hz} & **DCV** functions are in different slide-switch positions.

Note: The Hz trigger level is determined by the ACV or ACA function-range being in use. Press **RANGE** button to select different function-ranges and thus trigger levels manually.

ACA ^{Hz}, DCA (Models 186 & 189 only) & DC+ACA ^{Hz} (Model 189 only) functions

Set the slide-switch to select **A** function. Input is made through the clamp jaws for non-invasive current measurements. Defaults at **ACA** ^{Hz} Function. Press **SELECT** button momentarily and release to select the subject functions in sequence.

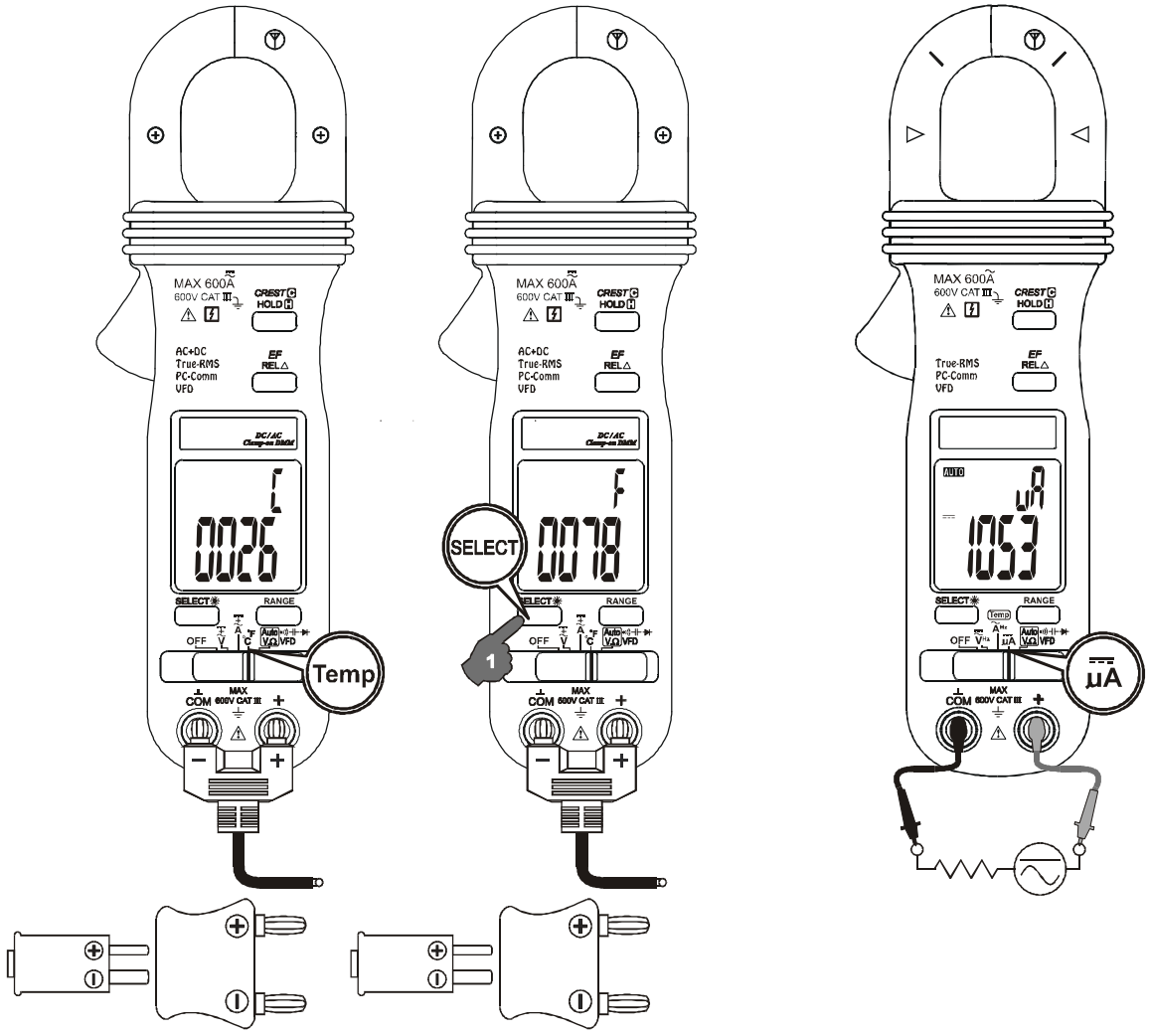


CAUTION (Application and removal of the Clamp-on meter)

For non-invasive current measurements, press the jaw trigger and clamp the jaws around conductor(s) of only one single pole of a circuit for load current measurement. Make sure the jaws are completely closed, or else it will introduce measurement errors. Enclosing conductor(s) of more than one pole of a circuit may result in differential current (like identifying leakage current) measurement. Locate the conductor(s) at the Jaws center as much as possible to get the best measuring accuracy. For removal, press the jaw trigger and remove the jaws from the conductor(s).

Adjacent current-carrying devices such as transformers, motors and conductor wires will affect measurement accuracy. Keep the jaws away from them as much as possible to minimize influence.

Temperature function (Models 185, 188 & 189 only)



For Model 189, defaults at **°C** (Celsius) readings. Press **SELECT** button momentarily and release to select **°F** (Fahrenheit) readings.
For Models 185 & 188, defaults at **ACA Hz** readings. Press **SELECT** button momentarily and release to select **°C** (Celsius) readings. Press **SELECT** button momentarily and release once again to select **°F** (Fahrenheit) readings.
Inputs are made through the test leads terminals. Be sure to insert the banana plug type-K temperature bead probe Bkp60 with correct **+ −** polarities. You can also use a plug adapter Bkb32 (Optional purchase) with banana pins to type-K socket to adapt other type-K standard mini plug temperature probes.

DCµA Current function (Models 185 & 188 only)

Set slide-switch to **DCµA** function position. Inputs are made through the test lead terminals.

Application notes:

The **DCμA** function is designed especially for HVAC/R flame sensor applications. The 0.1μA resolution is useful for identifying the minute current changes in flame detector applications. Flame signal current check should indicate steady flame signal of at least 2μA for a rectification type, or 1.5μA for an ultraviolet type (8μA for self checking systems). If a flame signal current with inadequate strength or fluctuation beyond 10%, check the following to avoid the risk of unwanted flame relay dropout :

For gas or oil flames (Minipeeper):
- Low supply voltage
- Detector location
- Defective detector wiring
- Dirty viewing windows
- Faulty Minipeeper

For oil flames (Photocell):
- Detector location & wiring
- Smoky flame or poorly adjusted air shutter
- Faulty Photocell
- Temperature over 165 F (74 C) at photocell

For gas flames (Flame Rod):
- Ignition interference (A flame signal current difference with the ignition both on and off greater than 0.5μA indicates the presence of ignition interference)
- Insufficient ground (must be at least 4 times the detector area)
- Flame lifting off burner head (ground), or not continuously in contact with the flame rod
- Temperature in excess of 600 ^{o}F (316 ^{o}C) at the flame electrode insulator causing short to ground.

AutoCheck™ mode

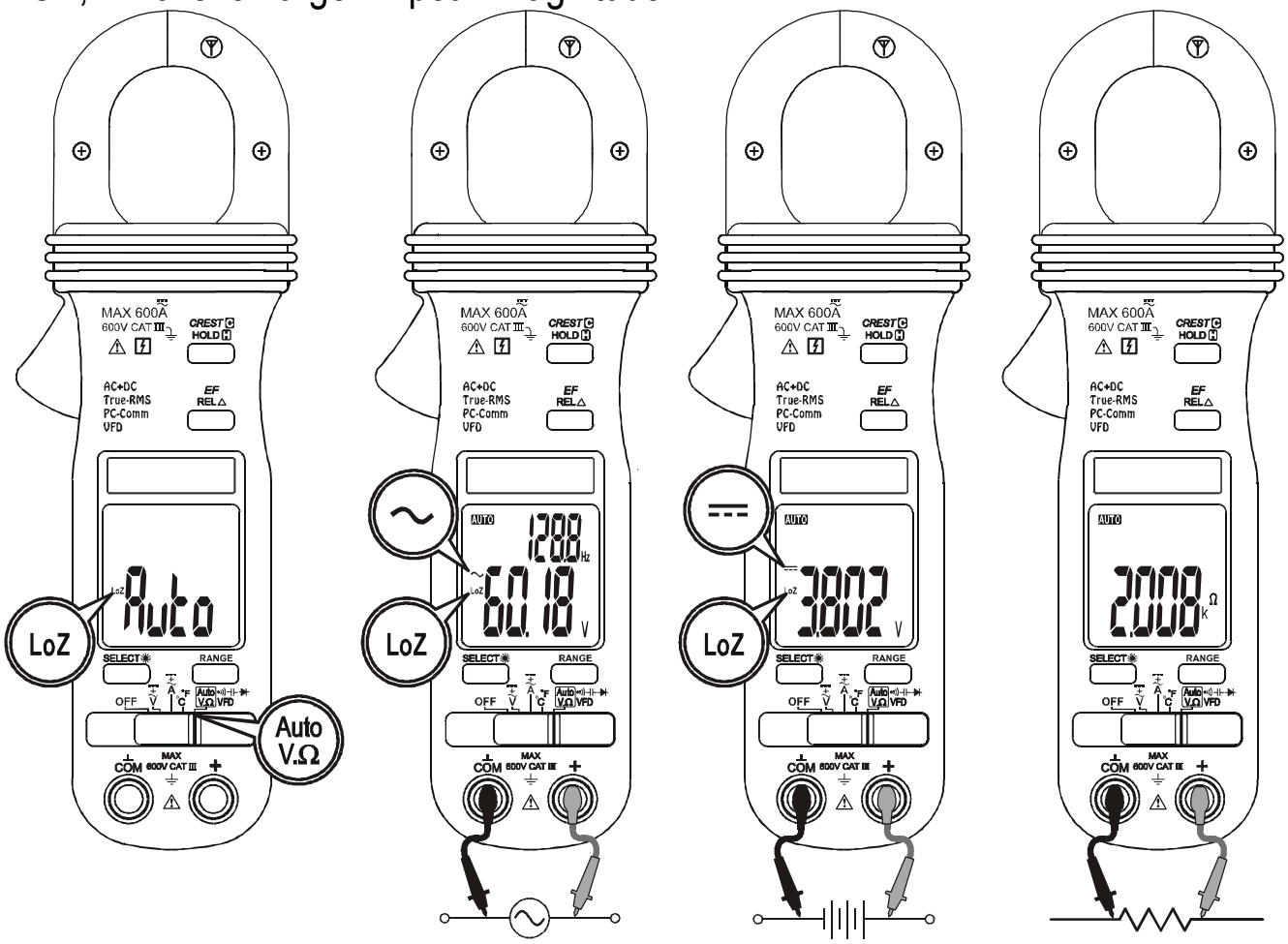
This innovative **AutoCheck™** feature automatically selects measurement function of **DCV**, **VFD-ACV** ^{Hz} (with low pass filters) or **Resistance (Ω)** based on the input via test leads.

●With no input, the meter displays "**Auto**" when it is ready.

●With no voltage signal but a resistance below 10MΩ (nominal) is present, the meter displays the resistance value. When the resistance is below the "Audible Threshold", the meter further gives a continuity beep tone.

●When a signal above the voltage threshold of 1.5V DCV or VFD-ACV up to the rated

600V is present, the meter displays the voltage value in appropriate DCV or VFD-ACV, whichever larger in peak magnitude.



Note:

****Range-Lock and Function-Lock Feature**: When a measurement reading is being displayed in **AutoCheck™** mode, press the **RANGE** or **SELECT** button momentarily 1 time can lock the range or function it was in. Press the button momentarily repeatedly to step through the ranges or functions.*

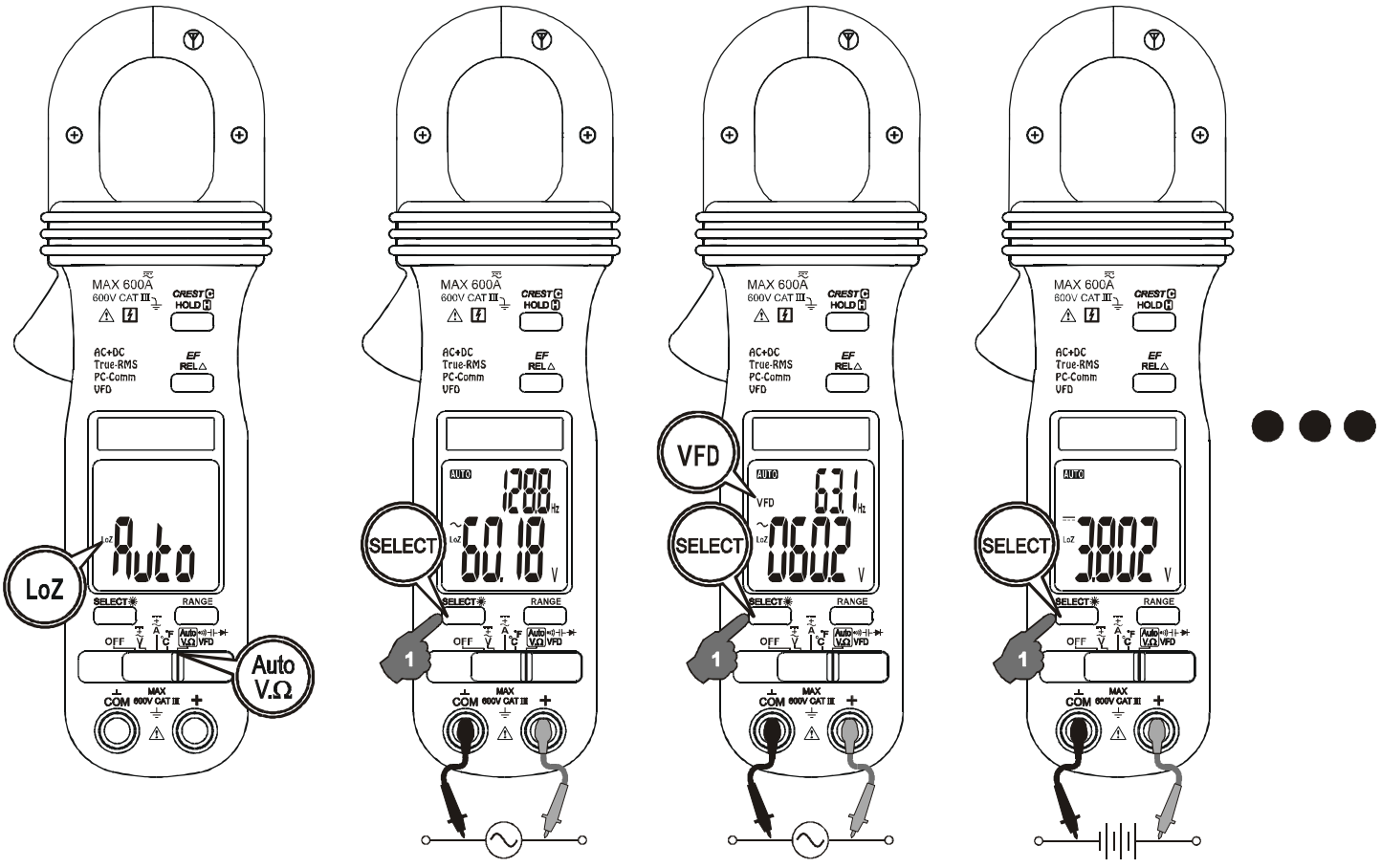
****As Hazardous-Alert**: When making resistance measurements in **AutoCheck™** mode, an unexpected display of voltage readings alerts you that the object under test is being energized.*

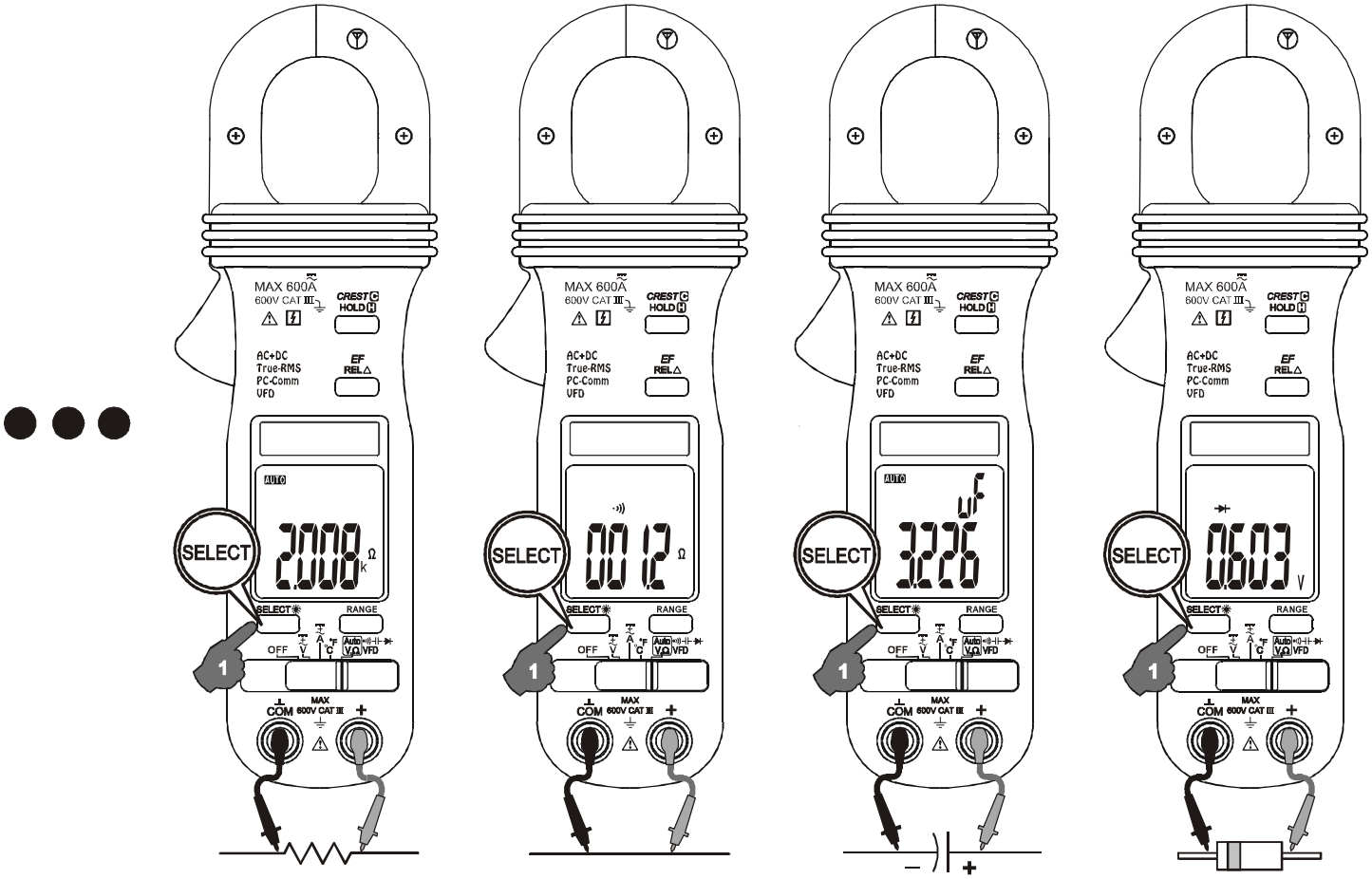
****Ghost-voltage Buster**: Ghost-voltages are unwanted stray signals coupled from adjacent hard signals, which confuse common multimeter voltage measurements. Our AutoCheck™ mode provides low (ramp-up) input impedance (approx. 2.5kΩ at low voltage) to drain ghost voltages leaving mainly hard signal values on meter readings. It is an invaluable feature for precise indication of hard signals, such as distinguishing between hot and open wires (to ground) in electrical installation applications.*

WARNING:

AutoCheck™ *mode input impedance increases abruptly from initial 2.5kΩ to a few hundred kΩ's on high voltage hard signals. "**LoZ**" displays on the LCD to remind the users of being in such low impedance mode. Peak initial load current, while probing 600VAC for example, can be up to 340mA (600V x 1.414 / 2.5kΩ), decreasing abruptly to approx. 3.4mA (600V x 1.414 / 250kΩ) within a fraction of a second. Do not use AutoCheck™ mode on circuits that could be damaged by such low input impedance. Instead, use slide-switch selector* $\tilde{\mathrm{V}}$ *or* $\overline{\tilde{\mathrm{V}}}$ *high input impedance voltage modes to minimize loading for such circuits.*

While in **AutoCheck™** function, press **SELECT** button momentarily and release to manually select the low input impedance (LoZ) **ACV** $^{\mathbf{Hz}}$, **VFD ACV** $^{\mathbf{Hz}}$ and **DCV** functions as well as the **Ω Resistance**, **•)) Continuity**, **⊣⊢ Capacitance** and **⊣◂ Diode** functions in sequence. For Model 186, **⊣⊢ Capacitance** and **⊣◂ Diode** functions are set in different slide function positions.





Note

1. Both ***ACV*** ^{Hz} *(LoZ) &* ***VFD ACV*** ^{Hz} *(LoZ) function selections are equipped with low pass filter to deal with VFD (Variable Frequency Device) signals.* ***VFD ACV*** ^{Hz} *(LoZ) selection, however, further pre-selects the most appropriate voltage-ranges and thus the Hz trigger levels to best cope with most VFD-Voltage and VFD-Frequency applications.*

2. When using Diode test function, normal forward voltage drop (forward biased) for a good silicon diode is between 0.400V to 0.900V. A reading higher than that indicates a leaky diode (defective). A zero reading indicates a shorted diode (defective). An OL indicates an open diode (defective). Reverse the test leads connections (reverse biased) across the diode. The digital display shows OL if the diode is good. Any other readings indicate the diode is resistive or shorted (defective).

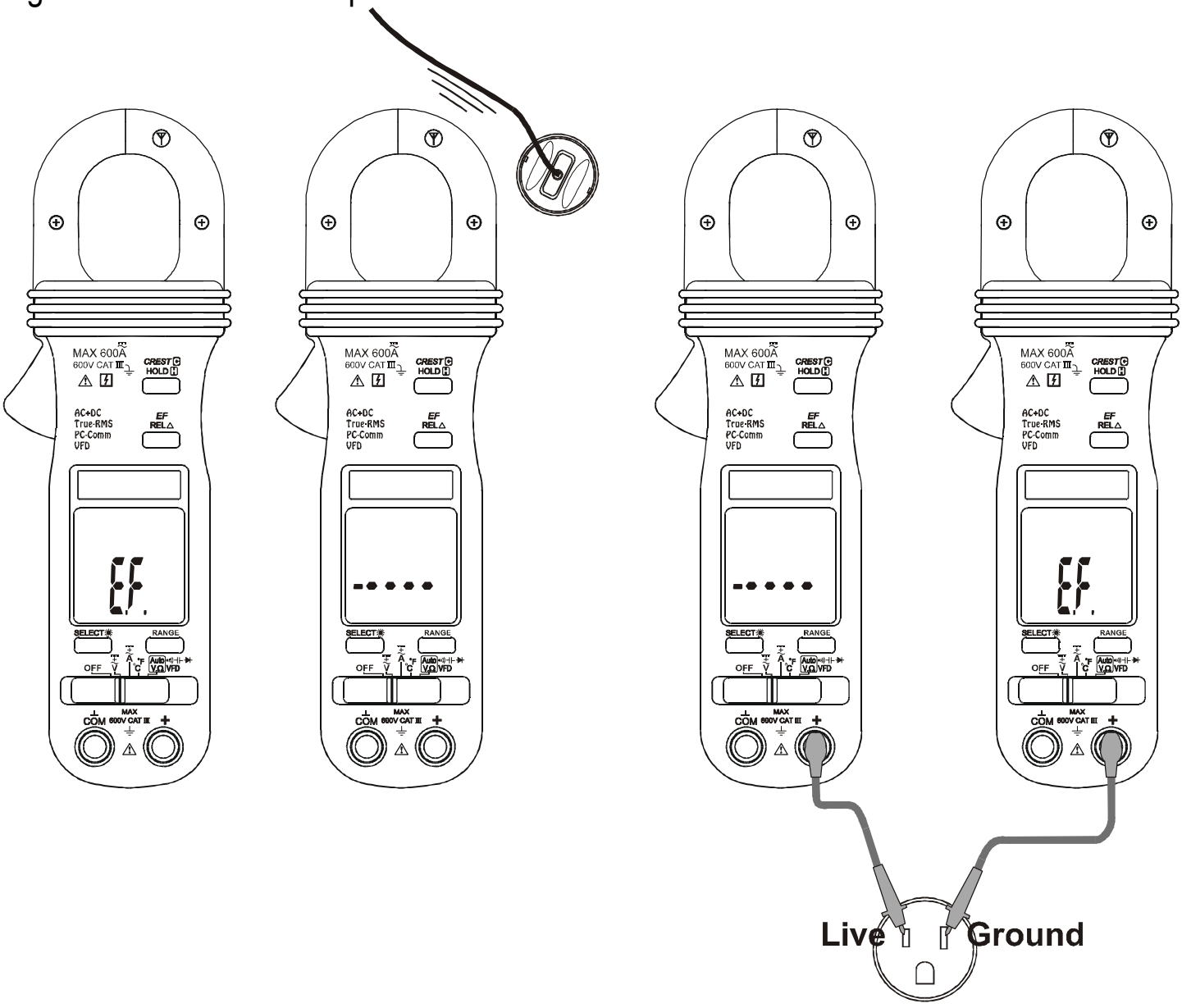
CAUTION

1. Using Resistance, Continuity, Diode or Capacitance function in a live circuit will produce false results and may damage the meter. In many cases the suspected component(s) must be disconnected from the circuit to obtain an accurate measurement reading.

2. When using Capacitance function, discharge capacitor(s) before making any measurements. Large value capacitors should be discharged through an appropriate resistance load

Electric Field EF-Detection

In Voltage, Current or Temperature function, press the EF button for one second or more and release to toggle to EF-Detection feature. The meter displays "**E.F.**" when it is ready. Signal strength is indicated as a series of bar-graph segments on the display together with variable beep tones.



●Non-Contact EF-Detection: An antenna is located along the top-right end of the clamp jaw, which detects electric field surrounds energized conductors. It is ideal for tracing live wiring connections, locating wiring breakage and to distinguish between live or

earth connections.

●Probe-Contact EF-Detection: For more precise indication of live wires, such as distinguishing between live and ground connections, use the Red (+) test probe for direct contact measurements.

PC computer interface capabilities

The instrument equips with an optical isolated interface port at the meter back for data communication. Optional purchase PC interface kit BRUA-13X is required to connect the meter to the PC computer RS232 or USB ports. *Press and hold the **HOLD** button while turning the meter on to enable meter PC-COMM output.*

Hold

The hold feature freezes the display for later view. Press the **HOLD** button momentarily and release to toggle the hold feature.

5ms CREST-MAX capture mode

Press **CREST** (HOLD) button for one second or more and release to activate CREST-MAX capture (Instantaneous Peak-Hold) mode to capture signal peak of voltage or current in duration as short as 5ms. The LCD "**C**" & "**MAX**" turn on. Press again the button momentarily and release can toggle the combination use of HOLD feature. Press the button for 1 second or more and release to exit CREST-MAX capture mode. Auto-ranging and Auto-Power-Off are disabled automatically in this mode.

Backlighted LCD display (Models 185, 188 & 189 only)

Press the **SELECT** button for 1 second or more to toggle the LCD backlight. The backlight will also be turned off automatically after 32 seconds to extend battery life.

Relative-Zero (Δ) mode

Relative-Zero allows the user to offset the meter consecutive measurements with the main display displaying reading as the reference value. Press the **REL** button momentarily and release to toggle Relative-Zero mode.

Manual or Auto-ranging

Press the **RANGE** button momentarily and release to select manual-ranging, and the meter will remain in the range it was in, the LCD AUTO turns off. Press the button again to step through the ranges. Press and hold the button for 1 second or more and release to resume auto-ranging.

Note: Manual-ranging feature is not available in **Hz** and ⊣⊢ function ranges.

Set Beeper Off

Press the **RANGE** button while turning the meter on to temporarily disable the Beeper feature. Turn the slide switch OFF and then back on to resume.

Auto-Power-Off (APO)

The Auto-Power-Off (APO) mode turns the meter off automatically to extend battery life after approximately 34 minutes of no rotary switch or push button operations. To wake up the meter from APO, press the **SELECT** button momentarily and release or turn the slide switch OFF and then back on. Always turn the slide switch to the OFF position when the meter is not in use

Disabling Auto-Power-Off

Press and hold the **SELECT** button while turning the meter on to temporarily disable the Auto-Power-Off (APO) feature. Turn the slide switch OFF and then back on to resume.

5) MAINTENANCE

WARNING

To avoid electrical shock, disconnect the meter from any circuit, remove the test leads from the input jacks and turn OFF the meter before opening the case. Do not operate with open case.

Trouble Shooting

If the instrument fails to operate, check batteries and test leads etc., and replace as necessary. Double check operating procedure as described in this user's manual.

If the instrument voltage-resistance input terminal has subjected to high voltage transient (caused by lightning or switching surge to the system under test) by accident or abnormal conditions of operation, the protective impedance components in series might be blown off (become high impedance) like fuses to protect the user and the instrument. Most measuring functions through this terminal will then be open circuit. Such components should then be replaced by qualified technician. Refer to the LIMITED WARRANTY section for obtaining warranty or repairing service.

Accuracy and Calibration

Accuracy is specified for a period of one year after calibration. Periodic calibration at intervals of one year is recommended to maintain meter accuracy. If self-diagnostic message "C_Er" (not available to Model 189) is being displayed while powering on,

some meter ranges might be largely out of specifications. To avoid mis-leading measurements, stop using the meter and send it for re-calibration. Refer to the LIMITED WARRANTY section for obtaining calibration, repairing or warranty service.

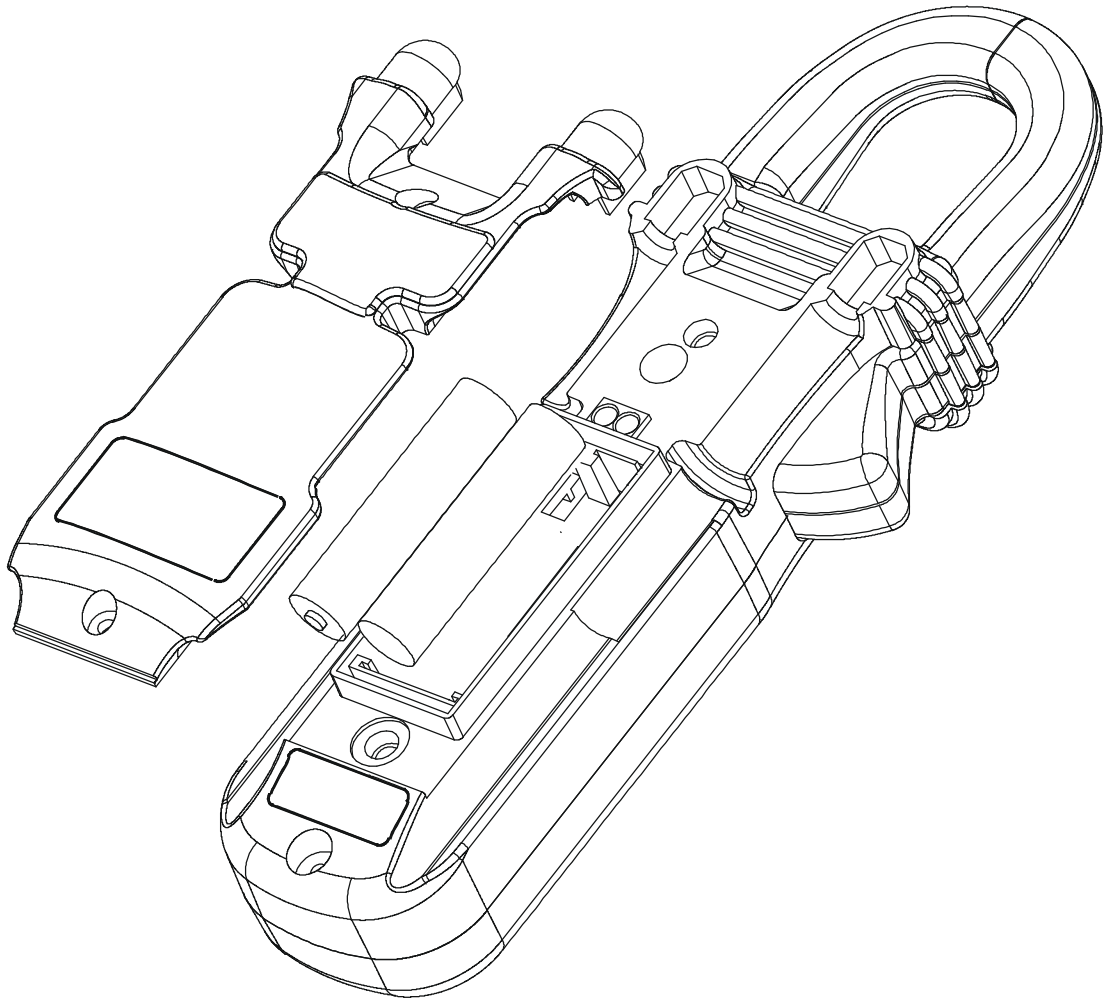
Cleaning and Storage

Periodically wipe the case with a damp cloth and mild detergent; do not use abrasives or solvents. If the meter is not to be used for periods of longer than 60 days, remove the batteries and store them separately.

Battery replacement

The meter uses standard 1.5V AAA Size battery X 2

Loosen the 2 captive screws from the battery cover case. Lift the battery cover case. Replace the batteries. Replace battery cover case. Re-fasten the screws.



GENERAL SPECIFICATIONS

Display: 3-5/6 digits 6000 counts. & 3-1/2 digits 1,999 counts for Hz
Polarity: Automatic
Update Rate: 5 per second nominal;
Operating Temperature: 0°C to 40°C

Relative Humidity: Maximum relative humidity 80% for temperature up to 31°C decreasing linearly to 50% relative humidity at 40°C

Pollution degree: 2

Storage Temperature: -20°C to 60°C, < 80% R.H. (with battery removed)

Altitude: Operating below 2000m

Temperature Coefficient: nominal 0.15 x (specified accuracy)/ °C @(0°C -- 18°C or 28°C -- 40°C), or otherwise specified

Sensing: Average sensing for Models 181, 185 & 186; AC True RMS for Models 183 & 188; AC & DC+AC True RMS for Model 189

Safety: Double insulation per IEC61010-1 2nd Ed., EN61010-1 2nd Ed., UL61010-1 2nd Ed. & CAN/CSA C22.2 No. 61010.1-0.92 to CAT III 600V and CAT IV 300V AC & DC

Transient Protection: 6.0kV (1.2/50μs surge)

Overload Protections:

Clamp-on jaws: 600A rms continuous

" + " & COM Terminals (all other functions): 600VDC/VAC rms

E.M.C.: Meets EN61326-1:2006 (EN55022, EN61000-3-2, EN61000-3-3, EN61000-4-2, EN61000-4-3, EN61000-4-4, , EN61000-4-5, EN61000-4-6, EN61000-4-8, EN61000-4-11)

In an RF field of 3V/m:

Capacitance function is not specified

Other function ranges: Total Accuracy = Specified Accuracy + 150 digits

Performance above 3V/m is not specified

Power Supply: 1.5V AAA Size battery X 2

Power Consumption: Typical 13mA for Current functions on Models 186 & 189; 5.2mA on others

Low Battery: Below approx. 2.4V

APO Timing: Idle for 34 minutes

APO Consumption: 10μA typical

Dimension: L190mm X W63mm X H32mm

Weight: 227 gm for Models 186 & 189; 179 gm for Models 181, 183, 185 & 188

Jaw opening & Conductor diameter : 30mm max for Models 186 & 189; 26mm max for Models 181, 183, 185 & 188

Accessories: Test leads (pair), user's manual, Bkp60 banana plug K-type thermocouple x 1 (Models 185, 188 &189 only)

Optional purchase accessories: USB interface kit BRUA-13X; BKB32 banana plug to type-K socket plug adaptor (Models 185, 188 &189 only)

Special Features: AutoCheck™ V&Ω; VFD-V & VFD-Hz; Backlighted LCD (Models 185, 188 &189 only); 5ms CREST-MAX Capture mode (Peak Hold); Auto-ranging Relative-Zero mode; Display Hold; EF-Detection (NCV); Interface capabilities with PC computers

Electrical Specifications

Accuracy is ±(% reading digits + number of digits) or otherwise specified, at 23°C ± 5°C & less than 75% relative humidity.

True RMS Models 183, 188 & 189 ACV (& DC+ACV on Model 189) accuracies are specified from 5 % to 100 % of range or otherwise specified. Maximum Crest Factor < 1.65 : 1 at full scale & < 3.3 : 1 at half scale, and with frequency components within the specified frequency bandwidth for non-sinusoidal waveforms.

DC Voltage

RANGE	Accuracy
6.000V, 60.00V, 600.0V & 600V [1)]	0.5%+5d

[1)]Added range to indicate instantaneous over-range voltage values

Input Impedance: 10MΩ, 50 pF nominal

AutoCheck™_ DCV

RANGE	Accuracy
6.000V, 60.00V, 600.0V & 600V [1)]	1.3% + 5d

[1)]Added range to indicate instantaneous over-range voltage values

AutoCheck™ Lo-Z DCV Threshold:

> +1.5VDC & < -1.5VDC nominal

AutoCheck™ Lo-Z DCV Input Impedance:

Initially approx. 2.5kΩ, 650pF nominal; Impedance increases abruptly within a fraction of a second as display voltage is above 50V (typical). Ended up impedances vs display voltages typically are:

15kΩ @100V
100kΩ @300V
250kΩ @600V

AC Voltage

RANGE	Accuracy
50Hz ~ 400Hz	
6.000V, 60.00V, 600.0V & 600V [1)]	1.2% + 5d

[1)]Added range to indicate instantaneous over-range voltage values

Input Impedance: 10MΩ, 50 pF nominal

CREST-MAX Capture Mode

Accuracy: Specified accuracy plus 250 digits for changes > 5ms in duration

AC+DC Voltage (Model 189 Only)

RANGE	Accuracy
DC, 50Hz ~ 400Hz	
6.000V, 60.00V, 600.0V & 600V [1)]	1.4% + 7d

[1)]Added range to indicate instantaneous over-range voltage values

Input Impedance: 10MΩ, 50 pF nominal

AutoCheck_ACV (with Low Pass Filter)

RANGE	Accuracy [1)]
5Hz ~ 20Hz	
6.000V, 60.00V, 600.0V & 600V [2)]	3.5%+80d
20Hz ~ 200Hz	
6.000V, 60.00V, 600.0V & 600V [2)]	2.0%+60d
200Hz - 400Hz [3)]	
6.000V, 60.00V, 600.0V & 600V [2)]	7%+80d

[1)]Not specified for fundamental frequency > 400Hz

[2)] Added range to indicate instantaneous over-range voltage values

[3)]Accuracy linearly decreases from 2% + 50d @ 200Hz to 7% + 80d @ 400Hz

AutoCheck™ Lo-Z ACV Threshold:

> 1.5V(50/60Hz) nominal

AutoCheck™ Lo-Z ACV Input Impedance:

Initially approx. 2.5kΩ, 650pF nominal; Impedance increases abruptly within a fraction of a second as display voltage is above 50V (typical). Ended up impedances vs display voltages typically are:
15kΩ @100V
100kΩ @300V
250kΩ @600V

Audible Continuity Tester

Audible Threshold: Between 10Ω and 200Ω
Response time: 32ms approx.

AutoCheck™_Ohm

RANGE [1]	Accuracy
600.0Ω, 6.000KΩ, 60.00KΩ	0.5%+5d
600.0KΩ	0.8%+5d
6.000MΩ	1.2%+5d
60.00MΩ [2]	2.3%+5d

Open Circuit Voltage: 0.45VDC typical

[1]AutoCheck™ Ohm Threshold:
< 10.00MΩ nominal

[2] Unspecified for range 40MΩ ~ 60MΩ on Models 186 & 189

Capacitance

RANGE	Accuracy [1]
60.00nF, 600.0nF, 6.000μF	2.0%+5d
60.00μF,600.0uF	3.5%+5d [2]
2000μF	4.0%+5d [2]

[1]Accuracies with film capacitor or better

[2]Temperature Coefficient: 0.25 x (specified accuracy)/ °C @(0°C -- 18°C or 28°C -- 40°C)

Diode Tester

RANGE	Accuracy
1.000V	1.0% + 3d

Test Current: 0.56mA typically
Open Circuit Voltage: < 1.8VDC typically

DCμA (Models 185 & 188 only)

RANGE	Accuracy	Burden Voltage
600.0μA, 2000μA	0.5%+5d	3.5mV/μA

Temperature (Models 185, 188 & 189 only)

RANGE	Accuracy
-50 °C ~ 1000 °C	0.3% +4d
-58 °F ~ 1832 °F	0.3% + 6d

K-type thermocouple range & accuracy not included

DCA Current (Clamp on)
(Models 186 & 189 Only)

RANGE	Accuracy [1] [2]
60.00A [3]	1.5%+8d
600.0A	1.5%+5d

[1]Induced error from adjacent current-carrying conductor:<0.01A/A

[2]Specified with Relative Zero Δ mode applied to offset the non-zero residual readings, if any

[3]Below 16% of range, add 10d to the specified accuracy

DC+ACA Current (Clamp on)
(Model 189 Only)

RANGE	Accuracy [1] [2]
DC, 40Hz ~ 400Hz	
60.00A [3], 600.0A	2.2%+10d

True RMS Crest Factor:
< 1.7 : 1 at full scale & < 3.4 : 1 at half scale

[1]Induced error from adjacent current-carrying conductor: < 0.01A/A

[2]Specified with Relative Zero Δ mode applied to offset the non-zero residual readings, if any

[3]Below 16% of range, add 10d to the specified accuracy

ACA Current (Models 186 & 189 Clamp on)

RANGE	Accuracy [1]
50Hz ~ 60Hz	
60.00A [2], 600.0A	1.5%+6d
40Hz ~ 400Hz	
60.00A [2], 600.0A	2%+6d

True RMS Crest Factor (Model 189 only):
< 1.7 : 1 at full scale & < 3.4 : 1 at half scale

[1]Induced error from adjacent current-carrying conductor: < 0.01A/A

[2]Below 16% of range, add 10d to the specified accuracy

ACA Current (Models 181, 183, 185 & 188 Clamp on)

RANGE	Accuracy[1] [2] [3]
50Hz ~ 400Hz	
60.00A,600.0A	1.8%+3d

True RMS Models BM183/188 Crest Factor:
< 2.5 : 1 at full scale & < 5.0 : 1 at half scale

[1]Add 12d to specified accuracy while reading is at 1 % to 10% of range

[2]Induced error from adjacent current-carrying conductor: < 0.05A/A

[3]Specified accuracy is from 1% to 100% of range and for measurements made at the jaw center. When the conductor is not positioned at the jaw center, position errors introduced are:

Add 1% to specified accuracy for measurements made WITHIN jaw marking lines (away from jaw opening)

Add 4% to specified accuracy for measurements made BEYOND jaw marking lines (toward jaws opening)

Hz Line Level Frequency

Function	Sensitivity (Sine RMS)	Range
6V	1V	10Hz ~ 1999Hz
60V	10V	10Hz ~ 1999Hz
600V	60V	10Hz ~ 1999Hz
60A	6A	20Hz ~ 400Hz
600A	60A	20Hz ~ 400Hz
VFD 6V [1]	1V~2V	10Hz ~ 400Hz
VFD 60V [1]	6~20V	10Hz ~ 400Hz
VFD 600V [1]	60V~200V	10Hz ~ 400Hz

Accuracy: 0.1%+4d

[1]VFD sensitivity linearly decreases from 10% F.S. @ 200Hz to 40% F.S. @ 400Hz

Non-Contact EF-Detection

Typical Voltage	Bar-Graph Indication
20V (tolerance: 10V ~ 36V)	-
55V (tolerance: 23V ~ 83V)	- - [1]
110V (tolerance: 59V ~ 165V)	- - - [2]
220V (tolerance: 124V ~ 330V)	- - - - [2]
440V (tolerance: 250V ~ 600V)	- - - - -

Indication: Bar-graph segments & audible beep tones proportional to the field strength

Detection Frequency: 50/60Hz

Detection Antenna: Top side of the stationary jaw

Probe-Contact EF-Detection: For more precise indication of live wires, such as distinguishing between live and ground connections, use the Red (+) test probe for direct contact measurement

[1]Models 186 & 189 display "- - -" instead

[2]Models 186 & 189 display "- - - - -" instead

LIMITED WARRANTY

BRYMEN warrants to the original product purchaser that each product it manufactures will be free from defects in material and workmanship under normal use and service within a period of one year from the date of purchase. BRYMEN's warranty does not apply to accessories, fuses, fusible resistors, spark gaps, batteries or any product which, in BRYMEN's opinion, has been misused, altered, neglected, or damaged by accident or abnormal conditions of operation or handling.

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